

REVOLVE Model Webinar

Optimising EVs and Storage for Consumer & Grid

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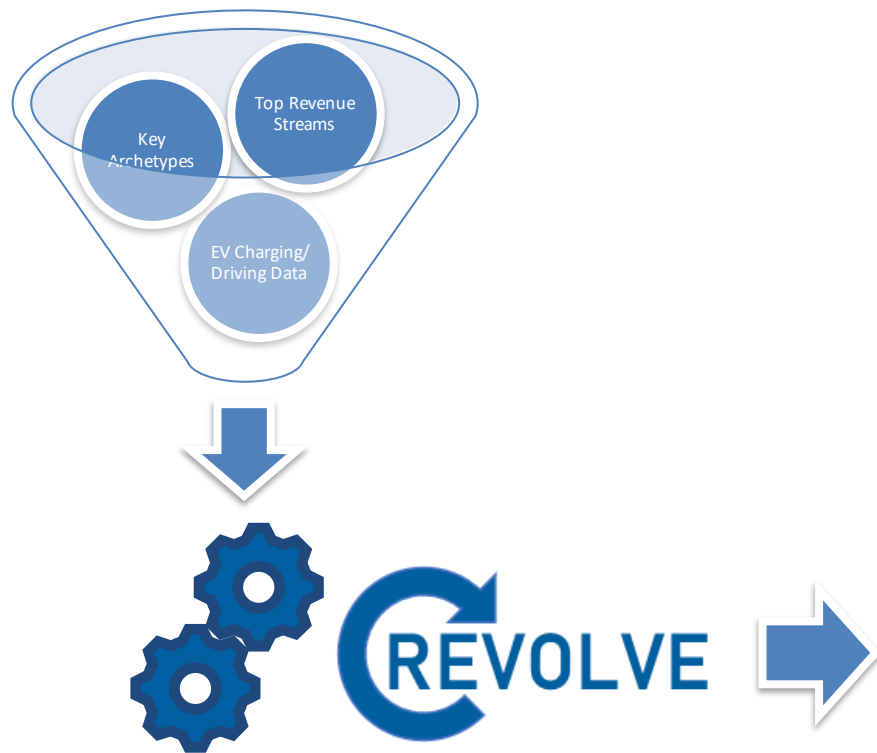
INTRODUCTION

- We'll talk about the REVOLVE model, what its for and its capabilities.
- Show a few results from the model
- Discus potential uses for the model

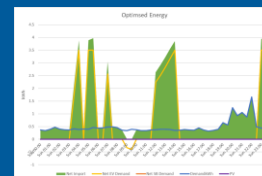
What is REVOLVE?

- A model developed by Cenex used in a number of R&D projects to assess business cases and asset performance.
- It models energy assets (e.g. EV charging, storage, PV) at half-hourly granularity.
- It works either with a single site, or a portfolio of distributed assets.
- REVOLVE is a perfect foresight optimisation model.
- It optimises based on cost, from energy tariffs and grid services.
- It can simulate and optimise up to 1,000 EVs.

HOW HAVE WE PREVIOUSLY USED REVOLVE



Optimised Charging Schedules & Grid Service Participation



Determining the Best V2G Customer Archetypes

Predictability
of Plug-in
Pattern

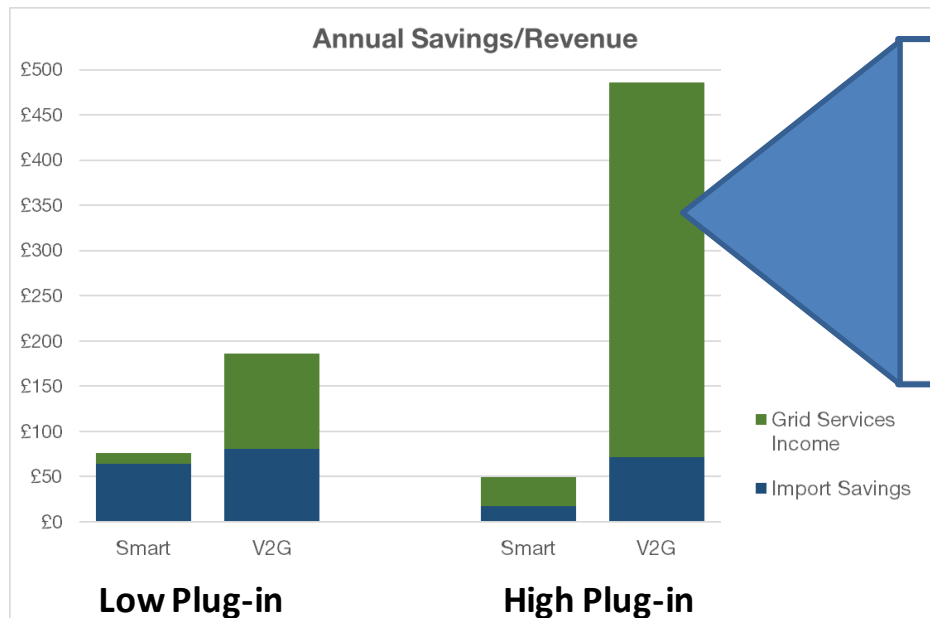
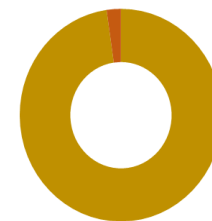
Plug-in
Duration

Journey
Demand

Battery Size

Plugged-in Not Charging (PiNC) time - %

AVERAGE SAVINGS FROM A PORTFOLIO OF EVS WITH V2G

**Grid Service Income Breakdown**

■ FFR ■ STOR ■ Demand Turn Up

PiNc time

24%

74%

Approx. Annual
Mileage

6,500

1,750

Savings/Revenues are based against a counterfactual of a residential customer on a single rate tariff with dumb charging. Smart/V2G bars are based on an Economy 7 tariff and access to TSO grid services.

WHAT CAN THE MODEL DO?

Technology Covered

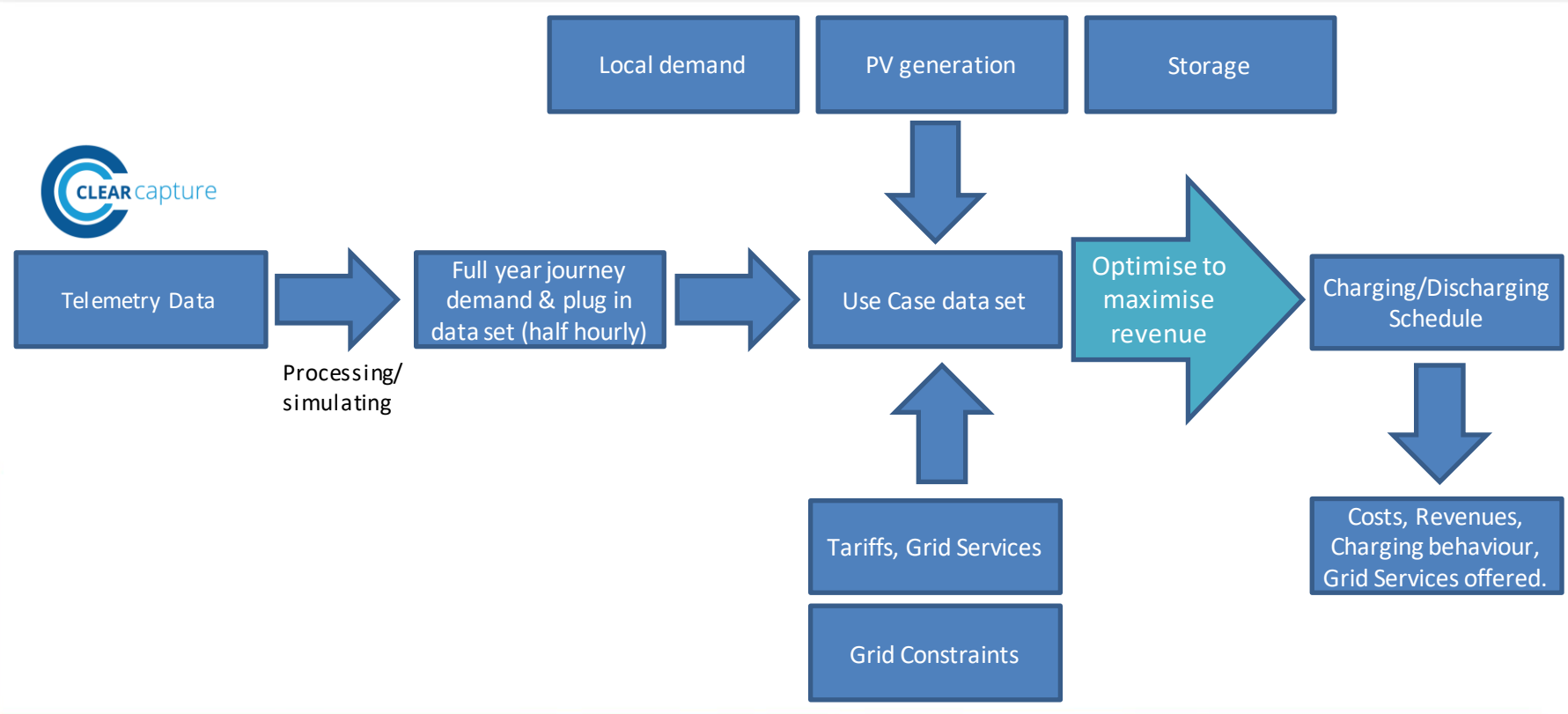
Technology	Inputs/Functionality
EVs	Plug in times and driving demands
PV	HH generation profile generated from array parameters
Wind	HH generation profile generated from wind speeds and power curve
Battery Storage	Power, storage capacity, charging/discharging efficiency
On-site dispatchable generation	Start costs, running costs.
Dumb charging	Power and efficiency
Smart Charging	Optimised to minimise cost
V2G	Bi-directional charging, optimised
Grid constraints	Maximum site import and export power

WHAT CAN THE MODEL DO?

Markets and Revenue Streams

Market	Inputs
Import Electricity	Half hourly varying power price (£/kWh)
Export Electricity	Half hourly varying power price (£/kWh)
Generation Tariff	Fixed revenue per kWh of generation
Grid Services (Reserve and response type products)	Availability price (£/MW/h), Utilisation price (£/MWh), minimum call length (h), utilisation percentage.

HOW IT WORKS





Transport



Energy
Infrastructure



Knowledge &
Enterprise

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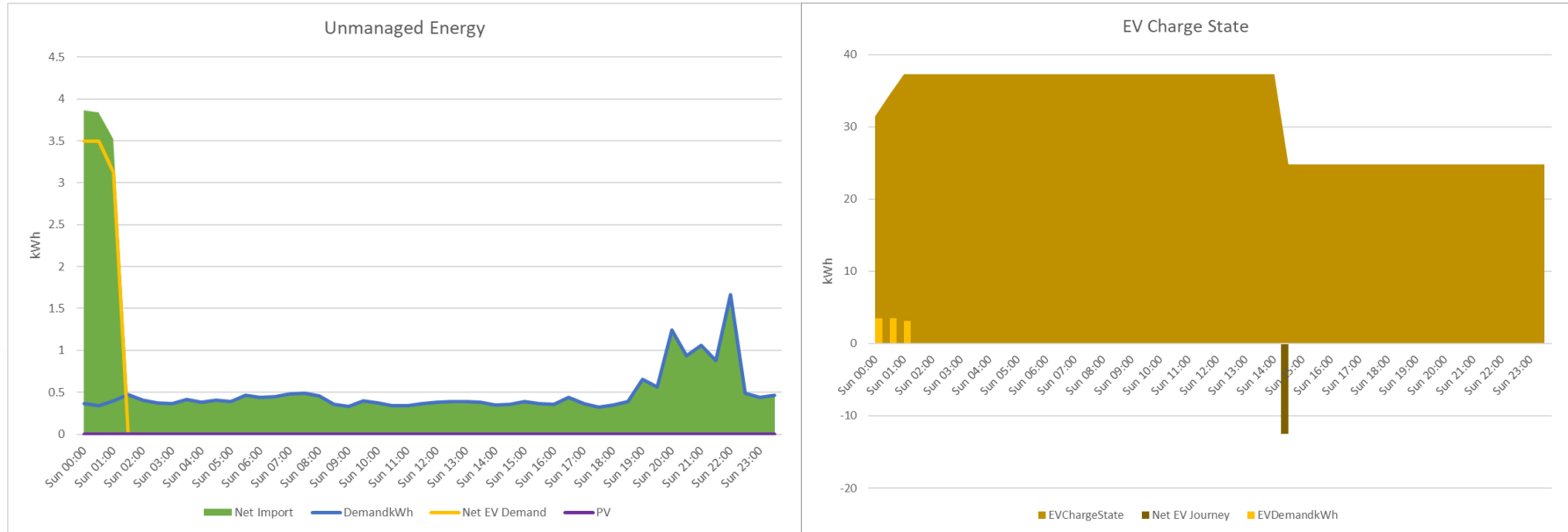


Detailed Simulation Results

Example EV charging schedules from a portfolio of 60 modelled

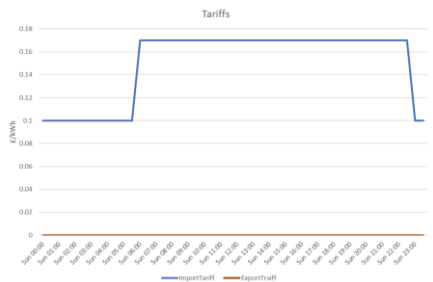
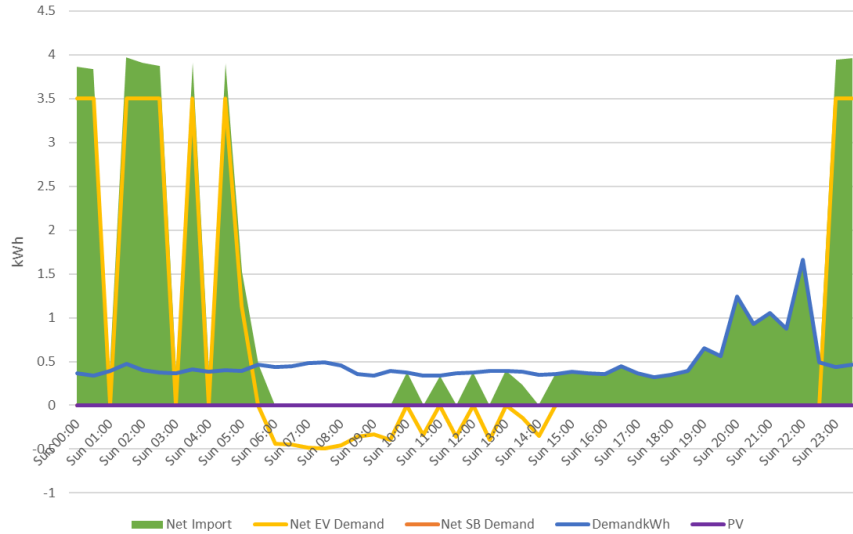
DETAILED OUTPUTS – UNMANAGED (DUMB CHARGING)

Full day simulation for Sunday in week 16 (single EV displayed)

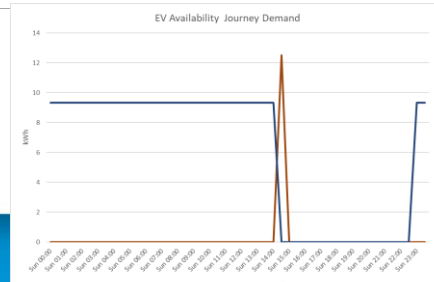
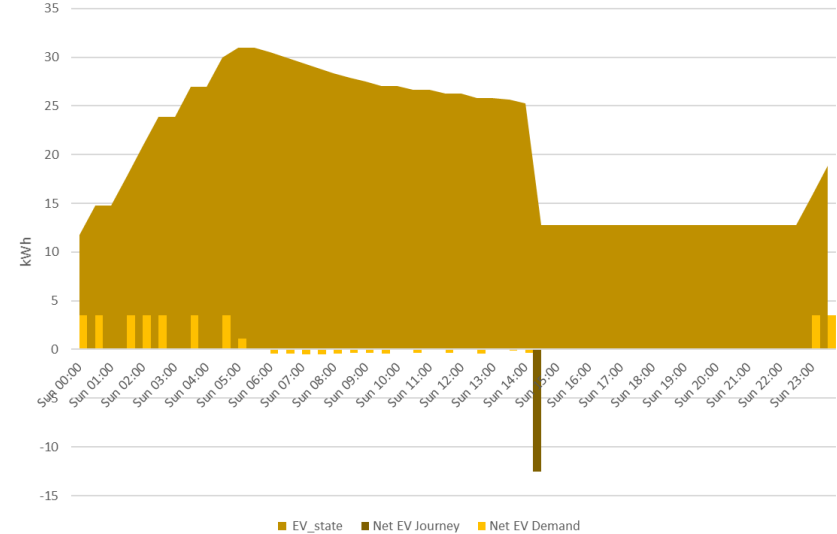


DETAILED OUTPUTS – OPTIMISED (V2G)

Optimsed Energy

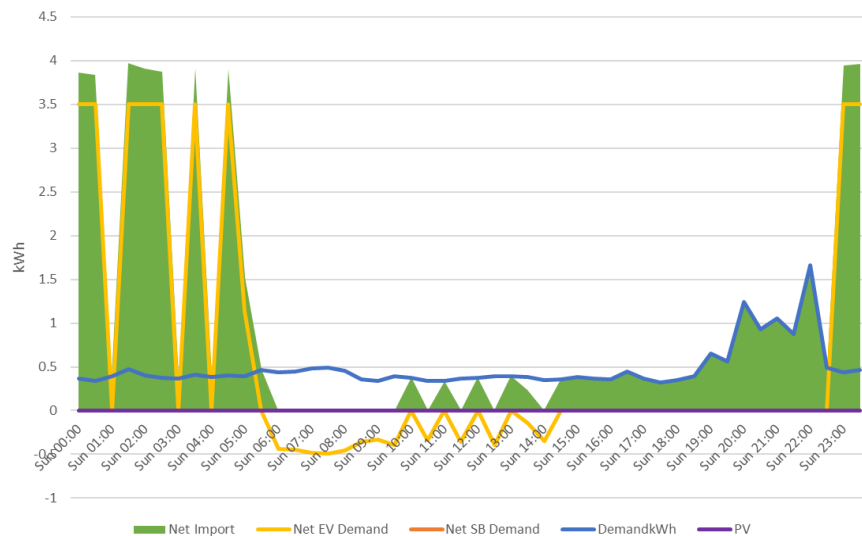


EV Charge State

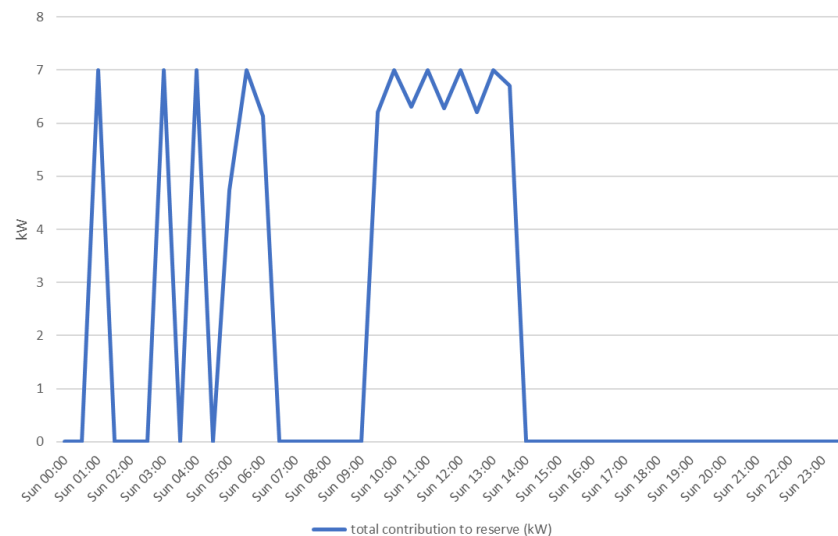


DETAILED OUTPUTS – GRID SERVICES OFFERED

Optimised Energy

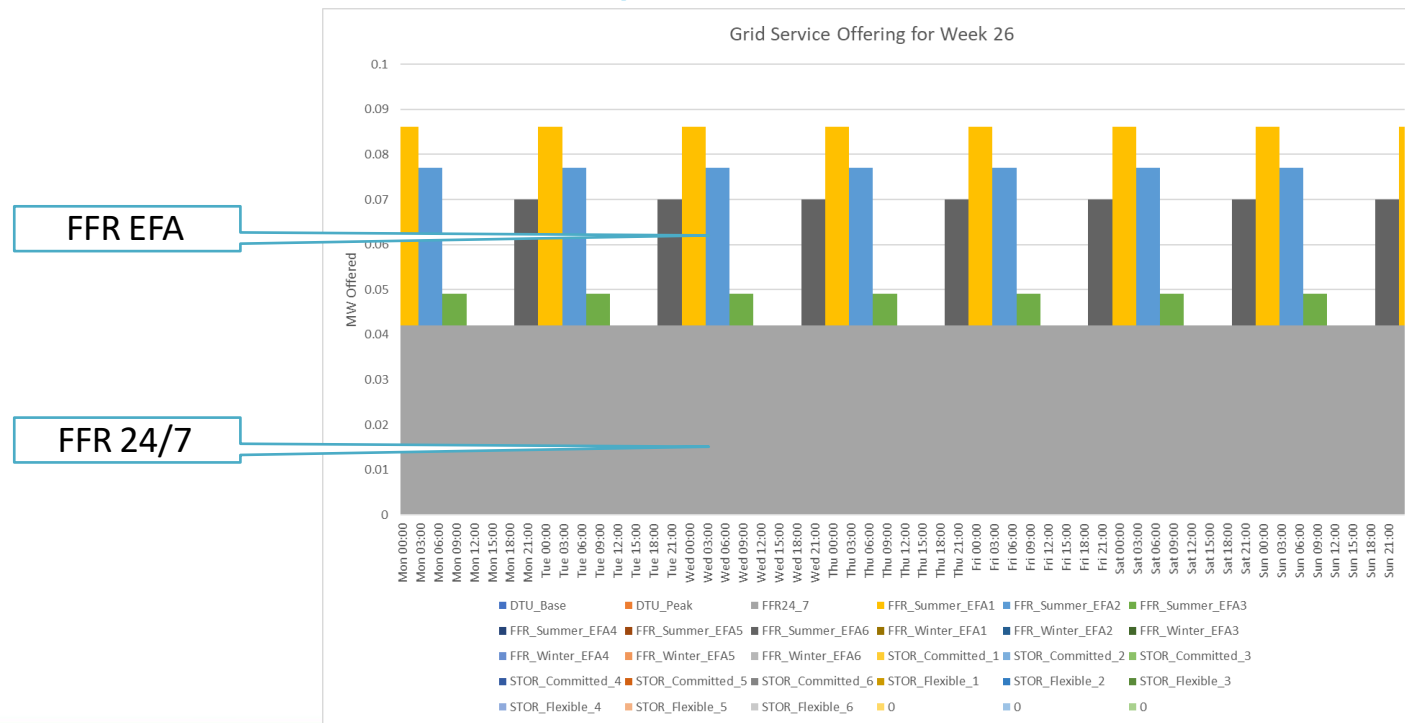


Reserve



DETAILED OUTPUTS – TOTAL GRID SERVICES OFFERED

Grid services offered from entire portfolio





Transport



Energy
Infrastructure



Knowledge &
Enterprise

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Broader Applications for REVOLVE

How REVOLVE might be able to help you

BROADER APPLICATIONS

It can provide insights such as:

- Average annual income from grid services for a V2G charge point within a larger V2G portfolio.
- Annual savings due to increased PV self-consumption for a PV + EV combination.
- Energy costs for a site with renewables, a grid constraint and a battery.
- Savings from smart charging with any given half hourly time of use tariff.
- Additional energy from renewables consumed due to an onsite battery.
- The operation and revenue for a stationary battery operating in balancing services.
- How much value Smart charging can capture versus V2G for different customer archetypes

Potential Projects:

- V2G business case
- Sizing PV and storage against a local demand
- Business case for storage batteries co-located with renewables
- Mitigation against network connection constraints

Thank you for listening
Questions..

Greg Payne

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If you wish to listen to the recording please contact us.

